Research and Development of an 3D Stereo Imagery as a Tool for Access Permit Management

ADAM (Automated Driveway Access Management) System

Presented by Joel Hearne

Presentation Outline

- Vision
- Research Findings
- Technologies Prototyped
- Technologies Used

Vision

To develop an automated highway driveway access permitting system that includes a 3D imagery viewer and GIS interface

Research Findings

GIS Technologies Researched and Developed for Access Management Purposes

- **Desktop GIS**
  - Custom Automated Land-Use Analysis
  - Integrated Systems
- **Web-Based GIS**
  - Inter-Agency Coordination
  - Mass Distribution of Spatial Data
- **Stereo GIS Data and 3D GIS**
  - Stereo GIS System
  - Digital Elevation and Landuse Models
  - 3D Visualization
- **Modeling the Right-of-Way**
  - Three GIS Basemaps
  - 3D Imagery via the Web
  - Identification of Regional “Hot-Spots” for Land-Use Change
  - Emerging Trends in GIS Data Standards and Warehouses

Research Findings

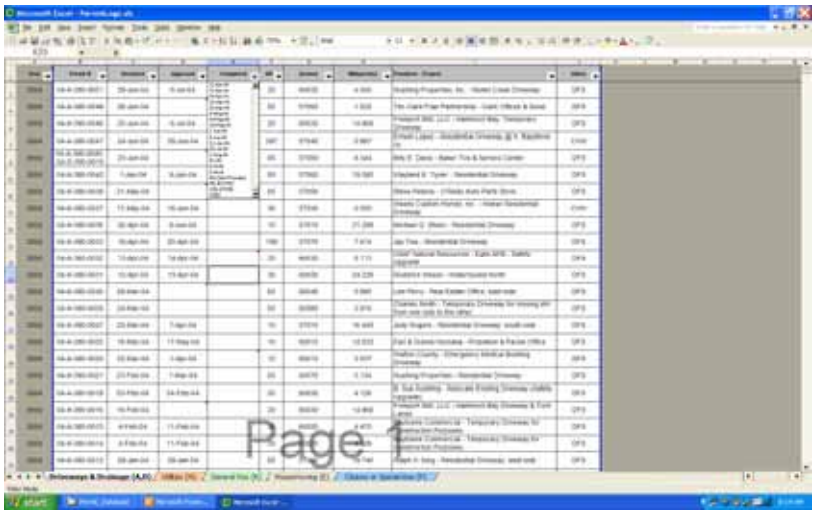
Paradigms for Spatially Modeling Transportation Networks

- Linear Networks GIS
  - Linear Referencing Along Routes
  - Roadways and Mileposts
  - Direction and Volume of Traffic Flow
- Cadastral GIS
  - Public Property Ownership Boundaries, Survey, Tax Assessment
  - Ubiquity of GIS Driving Trends Towards Standardization
  - Direction and Volume of Traffic Flow
- Physical GIS
  - Measuring 3-Dimensions from the Sky
  - Elevation Models
  - Visual-Simulations Affect High-Level Decision Making

Research Findings

Linear GIS – Roadways and Mileposts

- Accuracy Depends on the Quality of Referenced Roadway Route Da
- Makes Network GIS Analysis for Access Management Possible
- Means of Linking Permits with Other GIS Databases



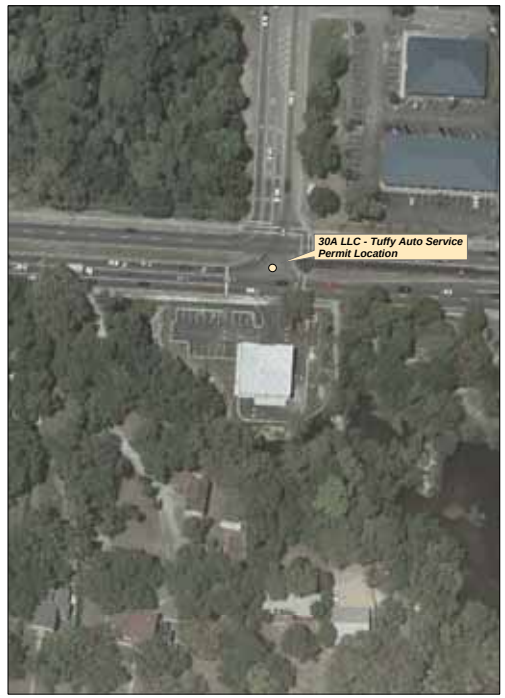
Linear Referencing Engine turns roadway and milepost tabular records into GIS data

Research Findings

Cadastral GIS – Land-Use and Ownership

- Requires cooperation between local, state, and federal governments
- Useful for Trip Generation and Future Land-Use Considerations
- Means of Linking Permits with Property Data

Before

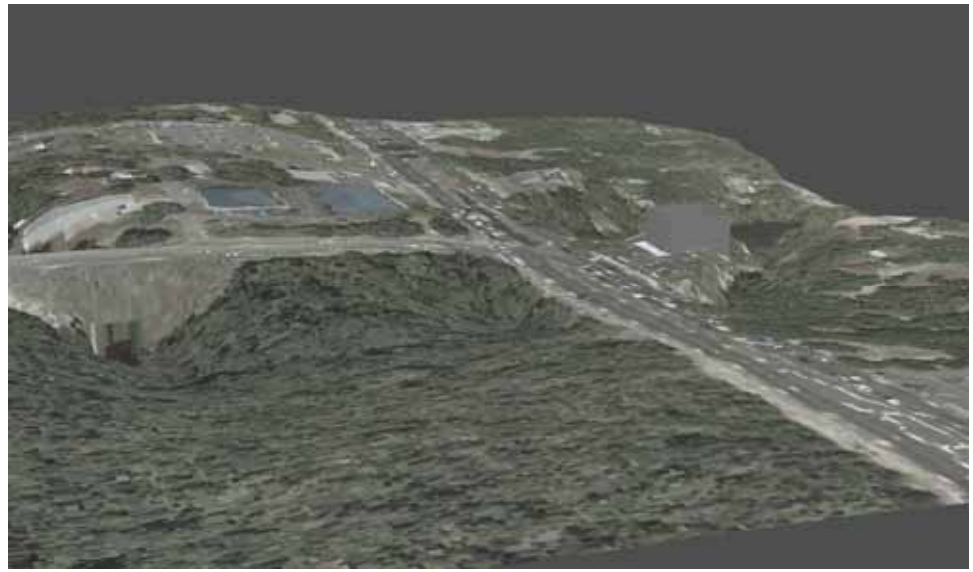


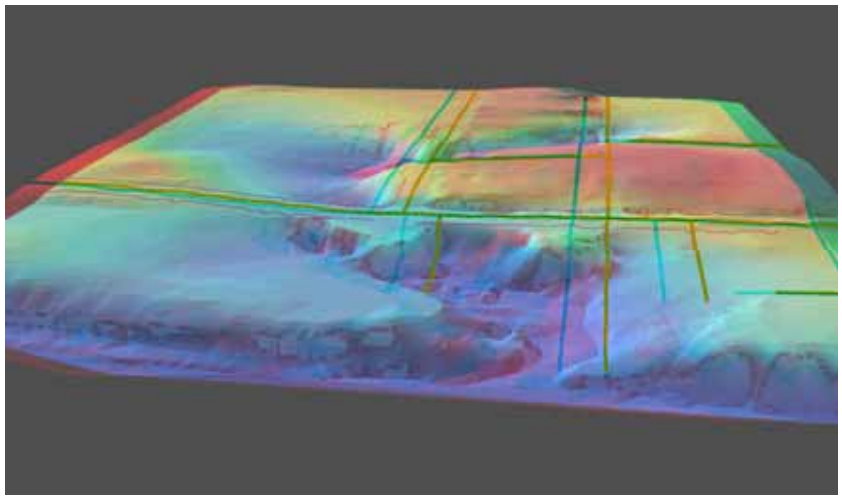
After

Research Findings

Physical GIS – 3D Modeling and Visualization

- Stereo (3D) Satellite and Aerial Photography
- Digital Elevation Models
- 3D Visualization



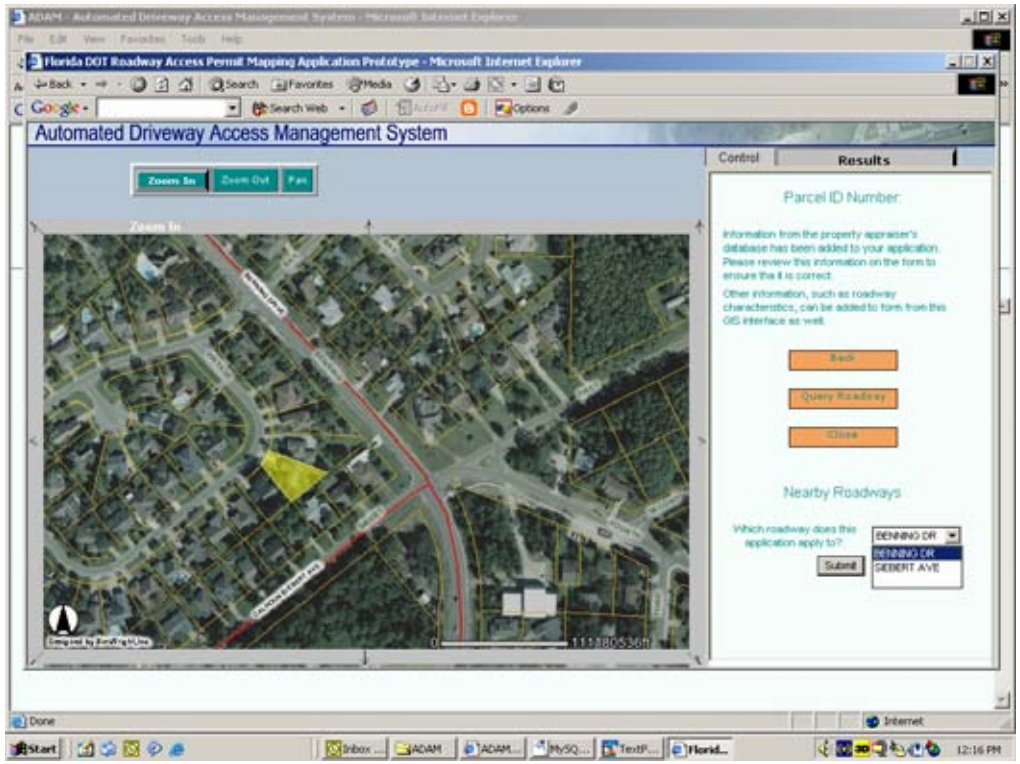


Technologies Prototyped

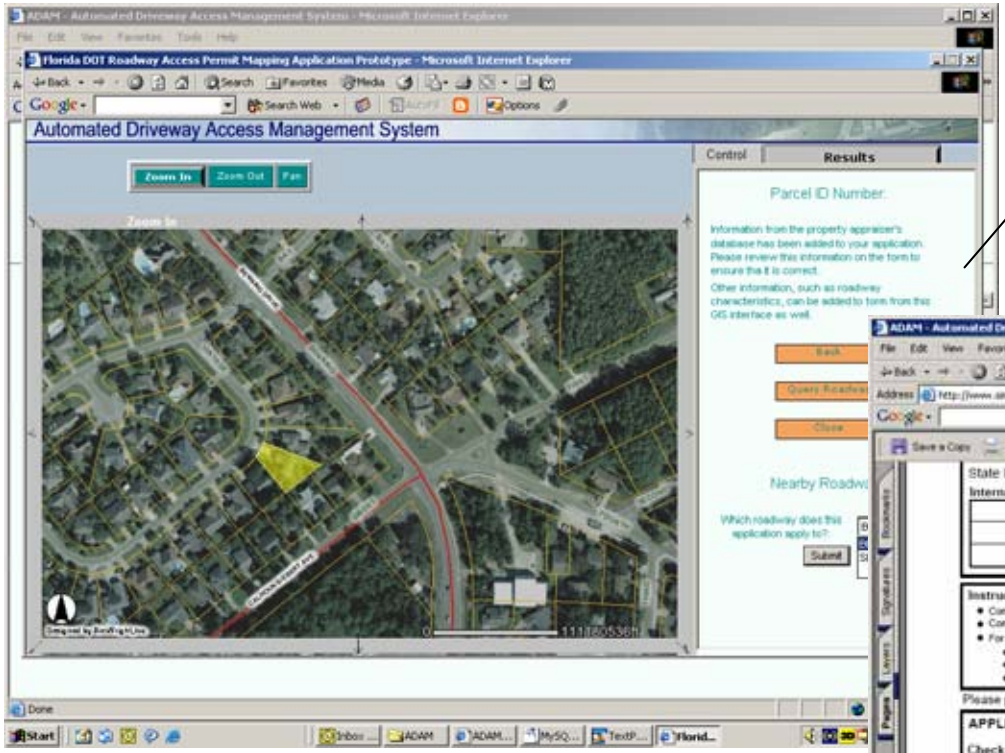
Automated Driveway and Access Management (ADAM) System

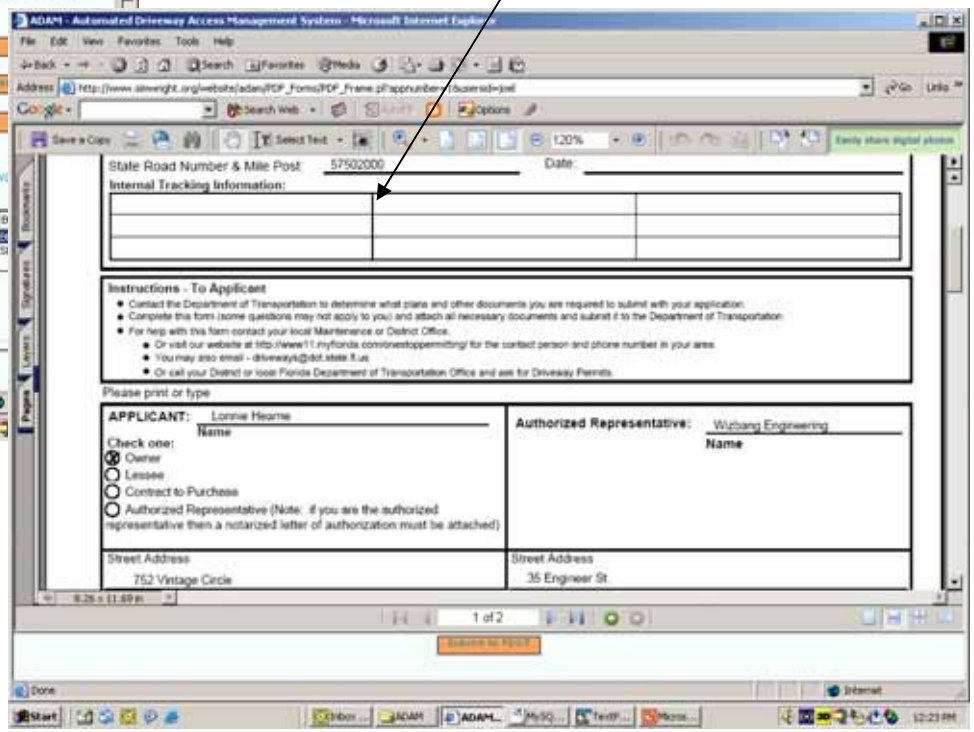
Web-Based Permit Application Forms

- GIS Enabled Forms
- Completes PDF Document
- Uses Stereo Imagery



Technologies Prototyped





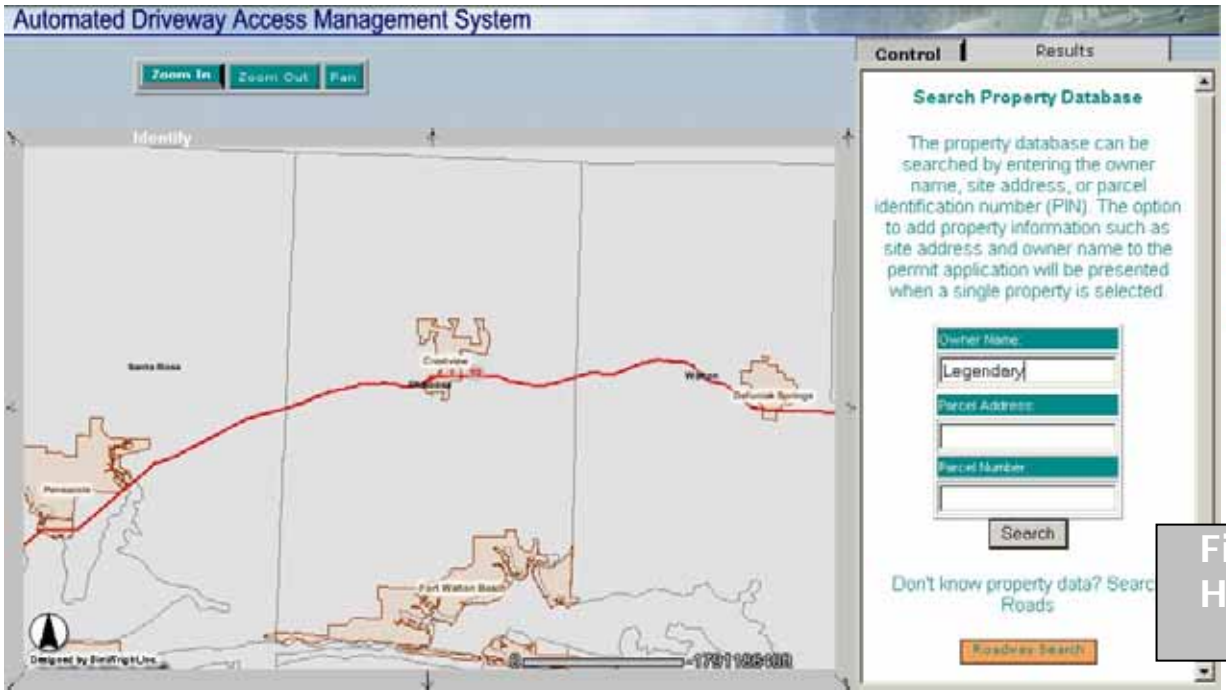
Automated Form Completion

GIS interface is used to establish geo-spatial reference for permit application. GIS analysis can then be used to identify nearby features such as roadways and mileposts that can subsequently be used to fill out portions of the application form.

Technologies Prototyped

Fill out application form manually — Application Form

Enter form data from map — Application Map



Step 1 - Step 2 - Step 3 - Step 4 - Step 5 - Step 6 - Step 7

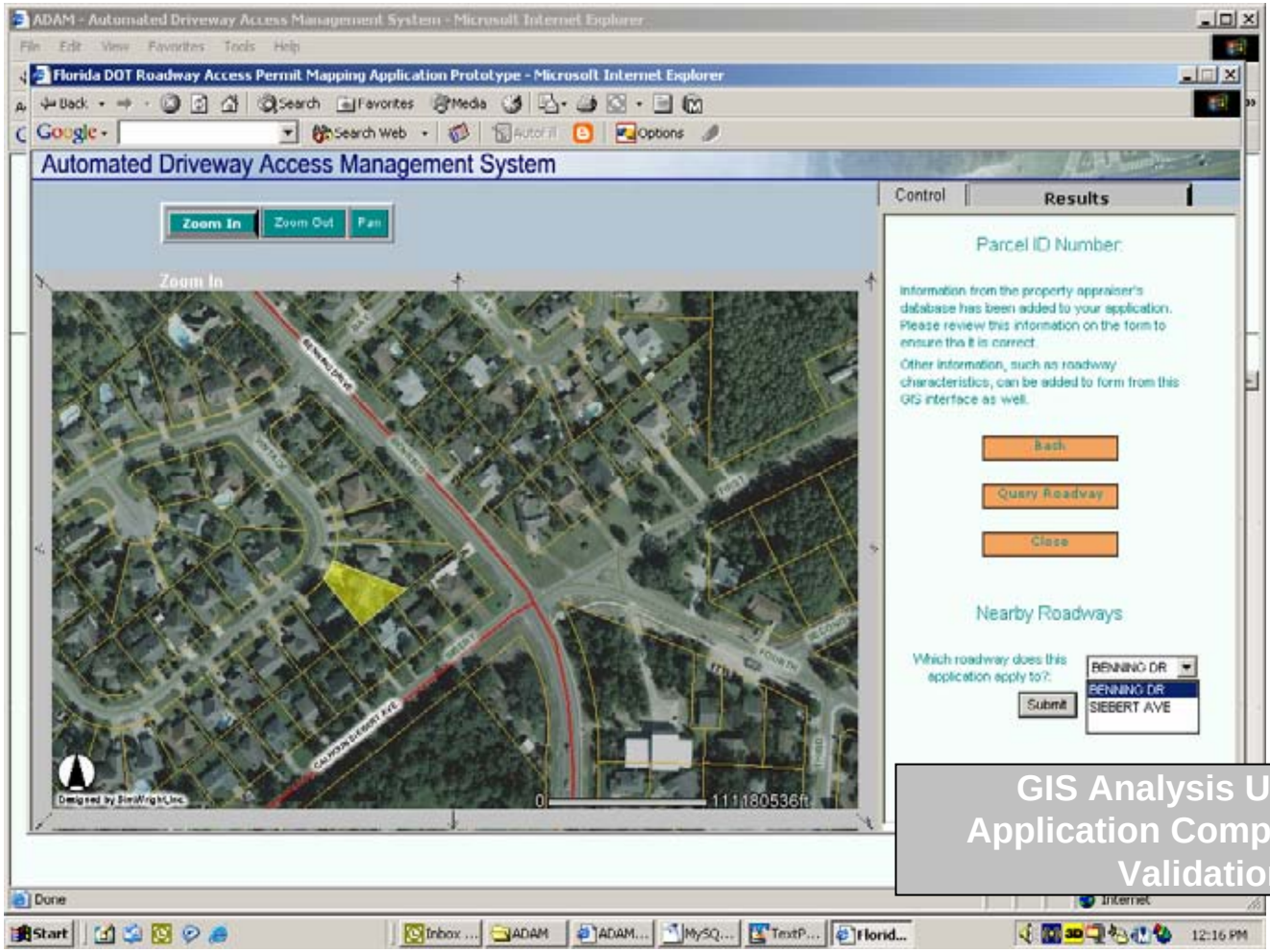
Information

Applicant Name:	
Applicant Type:	
Address:	
Address 2:	
City:	
State:	
Zip:	
Phone:	
Mobile:	
Email:	

<-- Back Next -->

Fill out form from traditional HTML form interface or from GIS interface

Technologies Prototyped

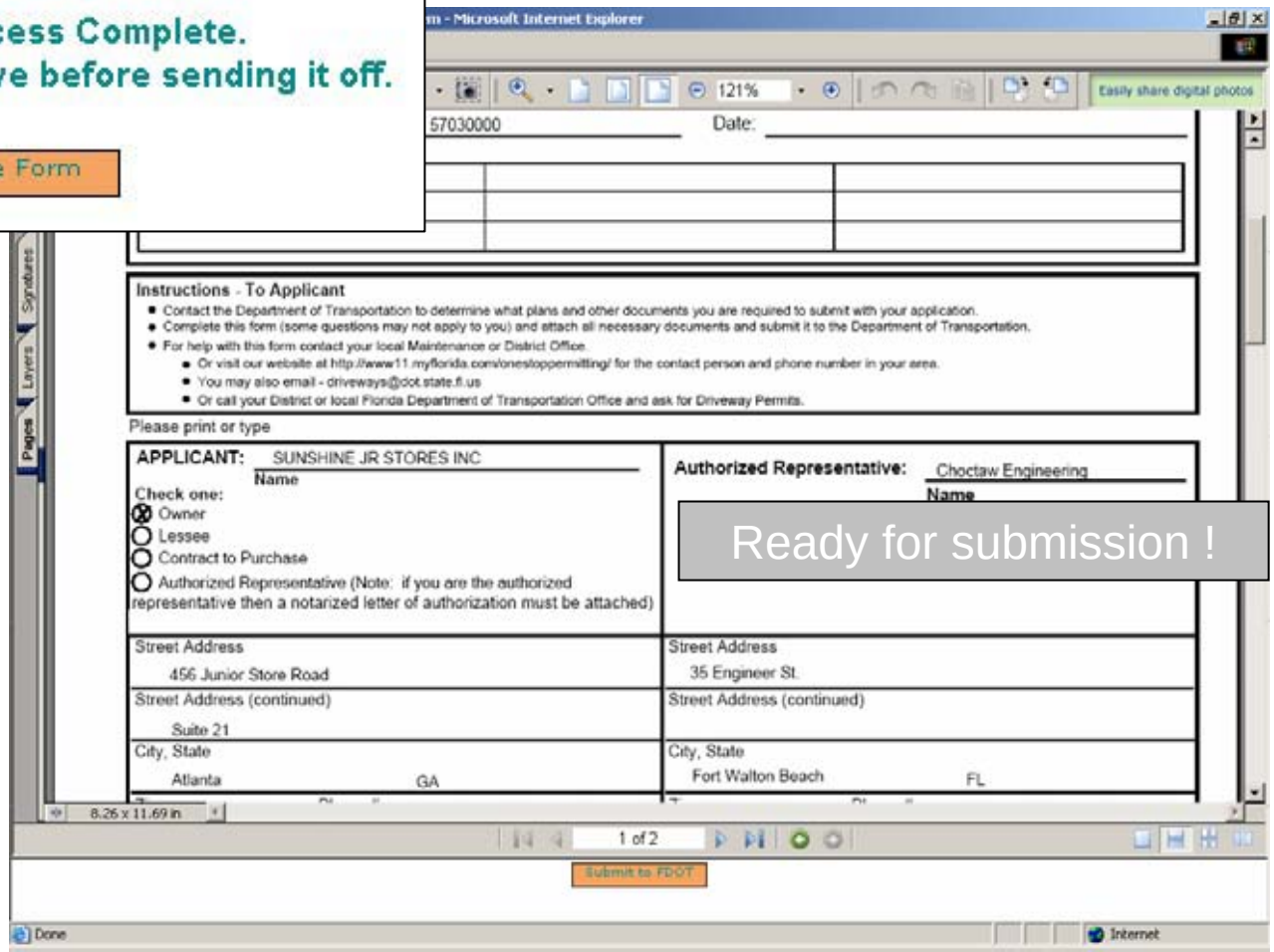


GIS Analysis Used for Application Completion and Validation

Technologies Prototyped

Application Process Complete.
Let's review what we have before sending it off.

Retrieve Form



Technologies Prototyped

Site Plan | Stereo View | Parcel Map | Milepost Map | Email Applicant | PDF Application

Roadway Access Permit Application

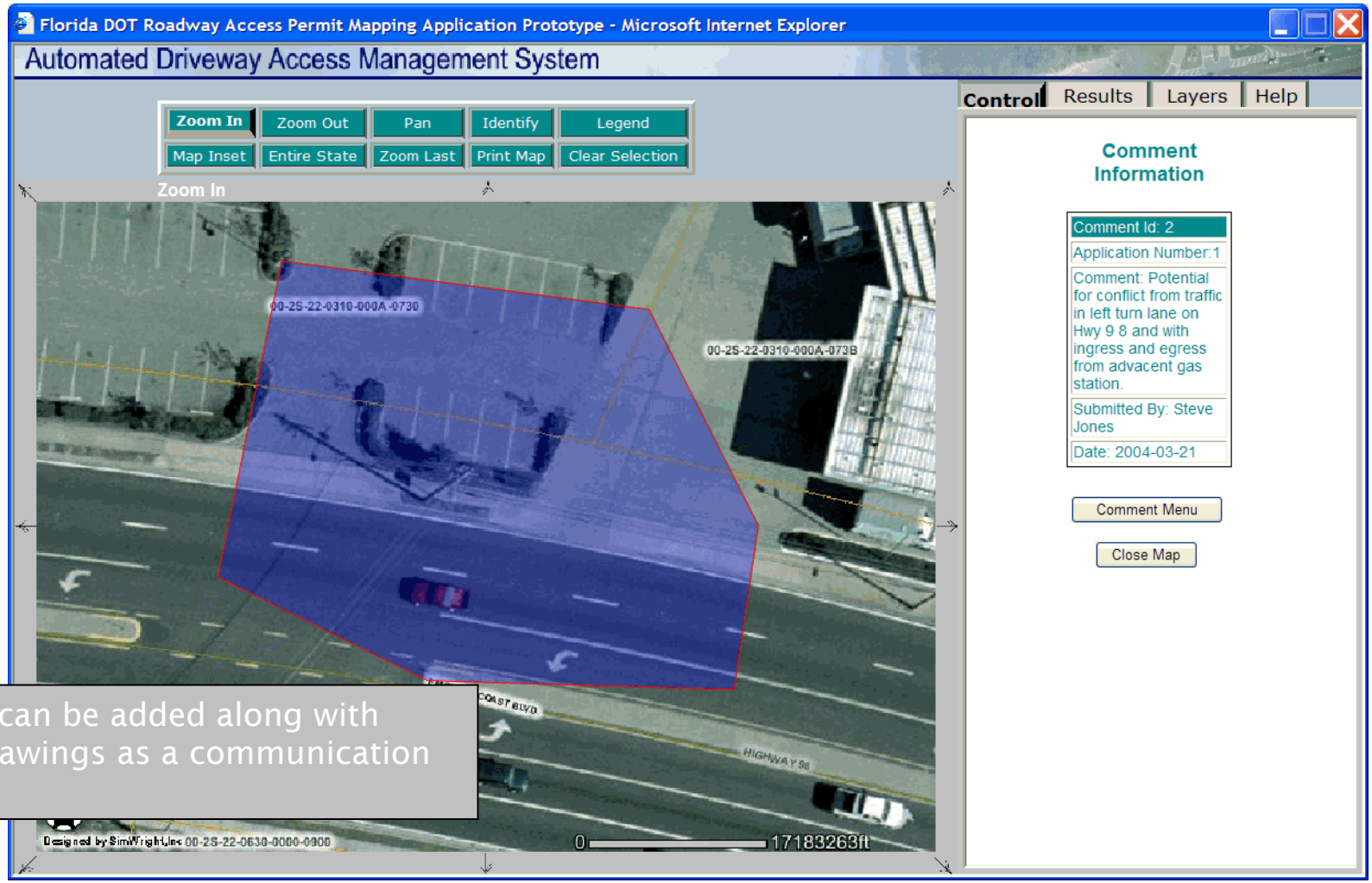
Permit Year:	2004	Application Number:	1
Date Received:	Sun Jul 18 21:59:18 2004		
Fee:	not collected	Receipt Number:	NA

Status:	Newly Submitted	Date of Last Status Change:	Sun Jul 18 21:59:18 2004
Land-Use:	COMMUNITY		
Applicant:	Kerry Christopher	Project Name:	Un-named
Address:	9344 Navarre Parkway	Address:	33 HWY 98
City:		City:	Destin
Zip:		State:	FL
Phone:		Zip:	32541
Agent:	Commercial	Phone:	(850)-939-8707
Firm:	Christopher Engineering	County:	Okaloosa
State Road:	Hwy 30	Roadway Section:	57030000
		Milepost End:	17.5
		Access Management Class:	4

Modify Records

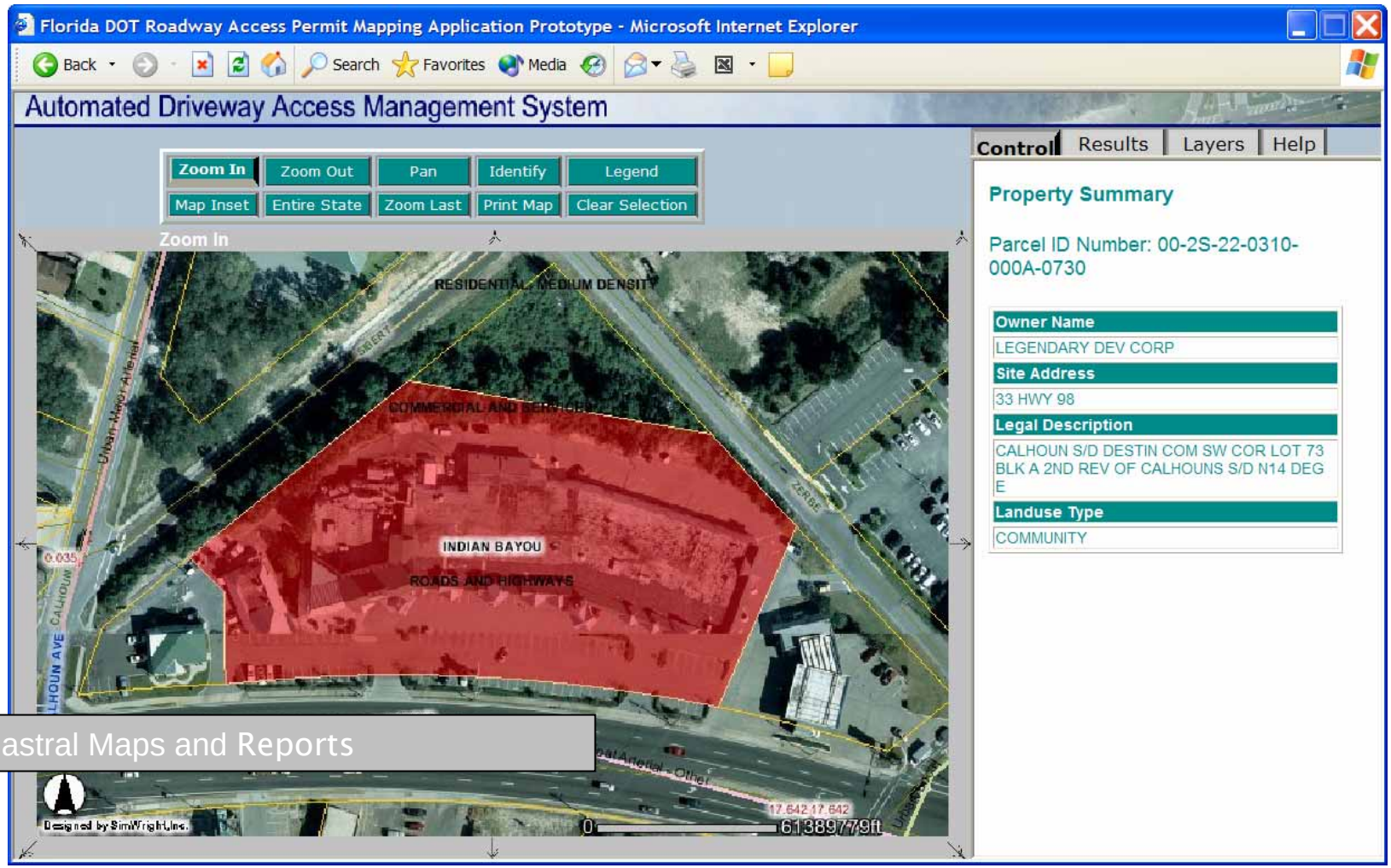
Reviewer Module is an information portal for permit application forms, property databases, roadway databases, and online map interfaces.

Technologies Prototyped



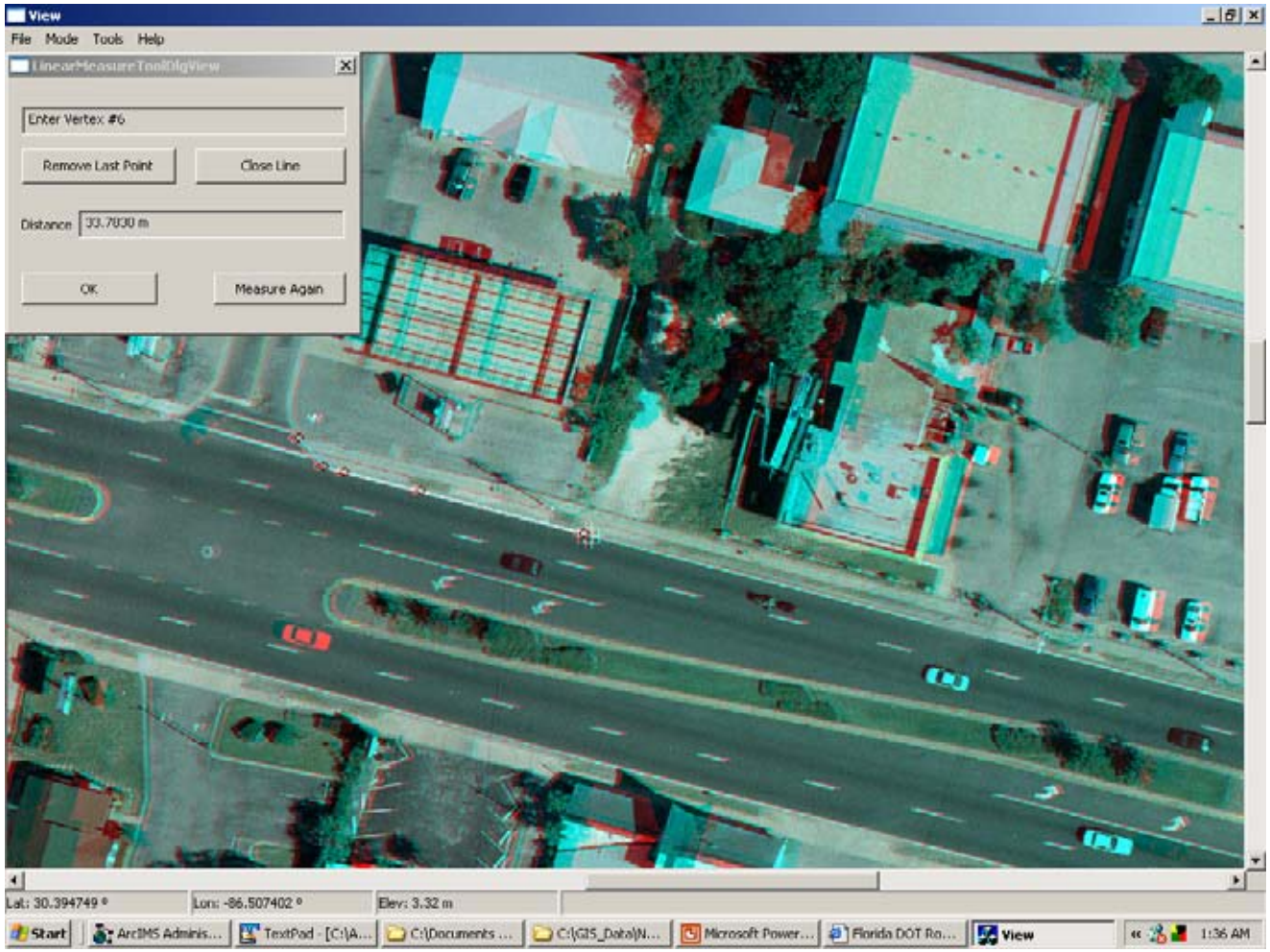
Comments can be added along with digitized drawings as a communication aid

Technologies Prototyped



Cadastral Maps and Reports

Technologies Prototyped



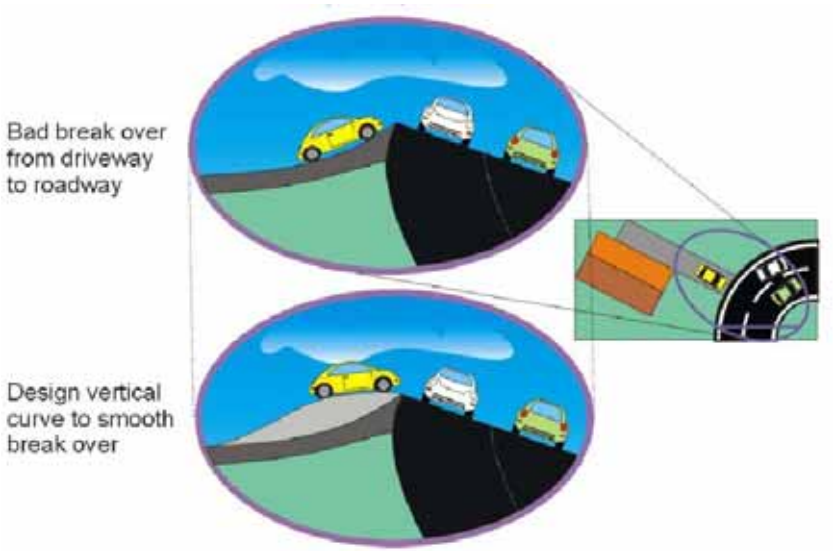
Internet Stereo Viewer

- Serves Large Stereo Images Over the Web
- Allows for Mass Distribution of 3D Data
- Gives the User a Highly Precise, Geo-Referenced 3D View of the Site
- Capable of highly accurate planimetric and 3D measurements

Technologies Prototyped

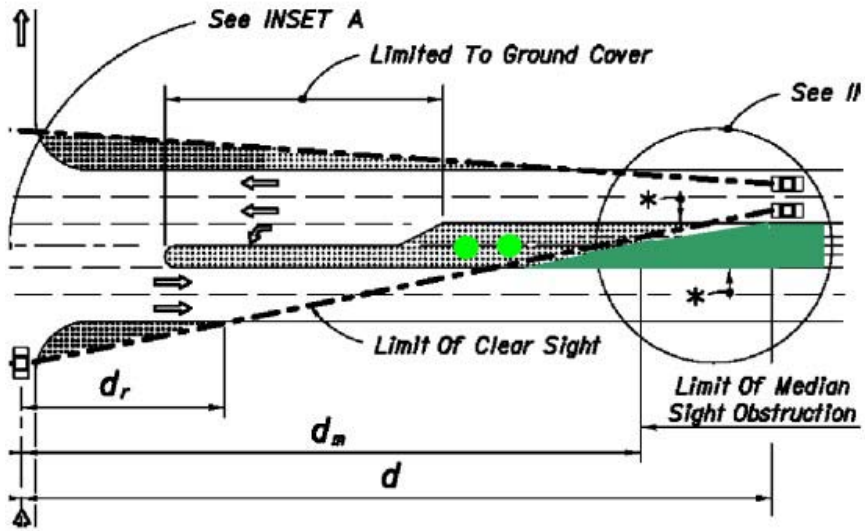
Applications for Stereo in Driveway Analysis

Driveway Grade Analysis



Source: Florida's Driveway Handbook Draft 07/02/2003 (Super Elevation and Driveway Visibility)

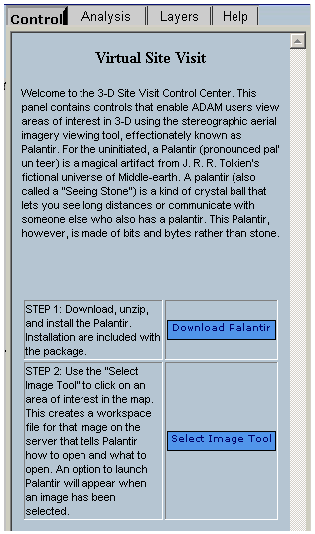
Visibility – Line of Site



Source: Standard Index 546 (Sight Distance at Intersections)

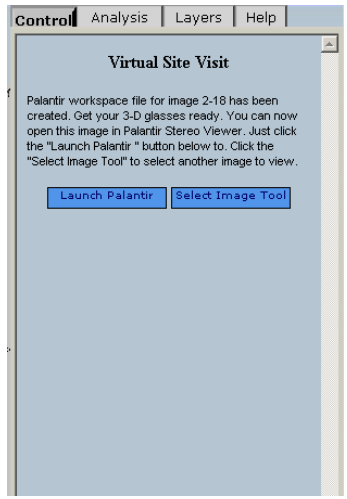
Technologies Prototyped

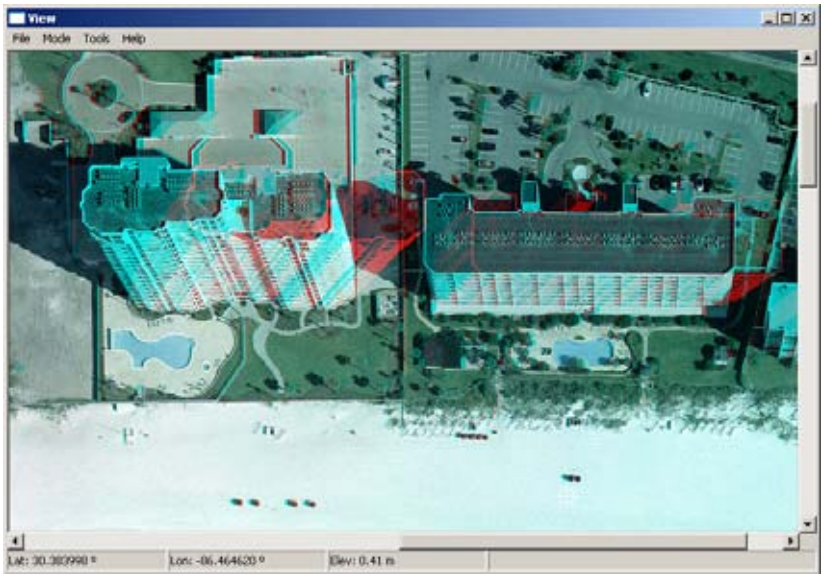
3D Viewer is standalone, but can also be controlled by ADAM



User clicks map

Launch 3D Viewer





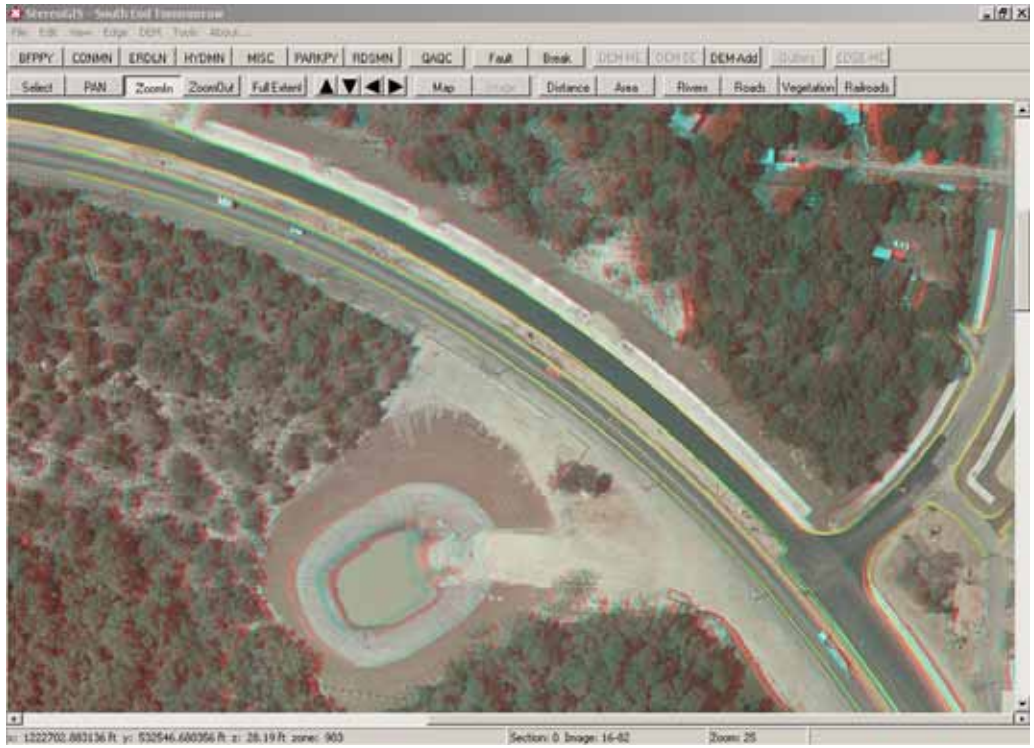
The first step to accessing 3D data is downloading and installing the software application. The user then uses the "Select Image" Tool to click on the area of interest on the map

The user clicks "Launch Palantir" puts on his or her anaglyph or shuttle glasses and views the 3D imagery

Technologies Used

3D Feature Extraction

- Stereo Imagery is used to extract precision GIS data such as curb-lines, parking lot boundaries, and elevation points that are useful for Access Management
- Feature's extracted from Stereo Imagery have been found to be accurate to within three centimeters

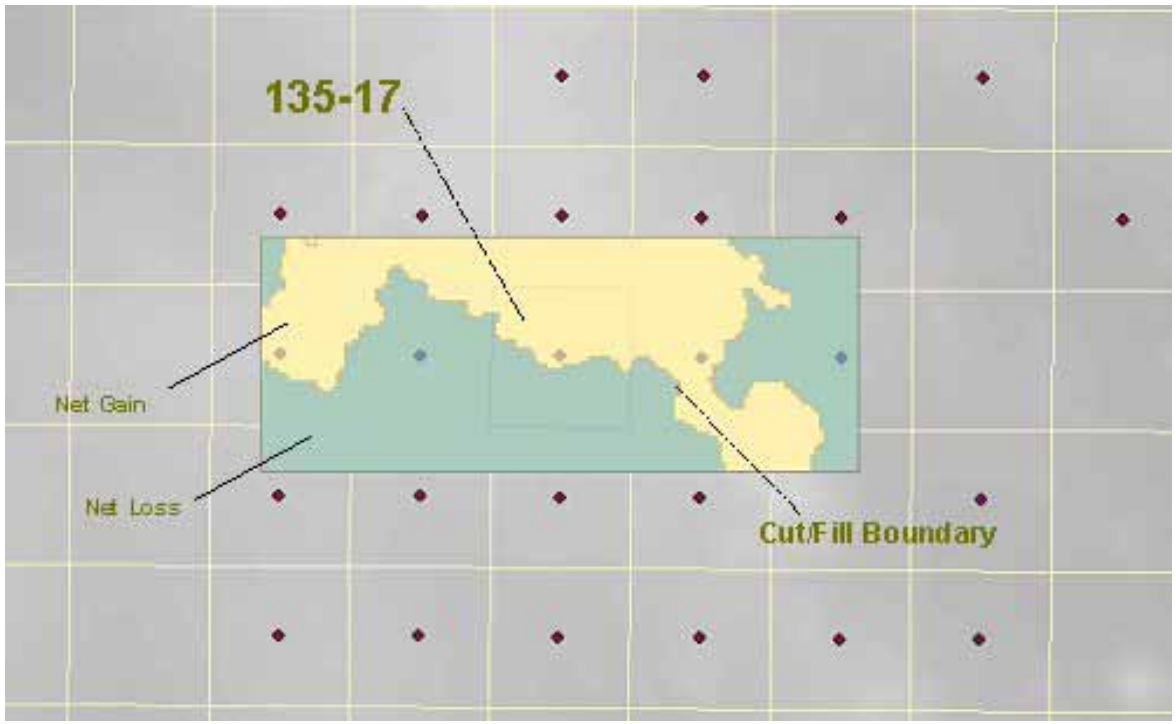


Technologies Used

Products Derived from Stereo Imagery

- SBIR Technologies have been used to solve volumetric engineering problems for Right-of-Way land acquisition and vehicle access

- Features such as elevation points, roadways, parking lots, building footprints, and cultural textures have been used to develop 3D visualization models for presentation to the public and land-use decision makers

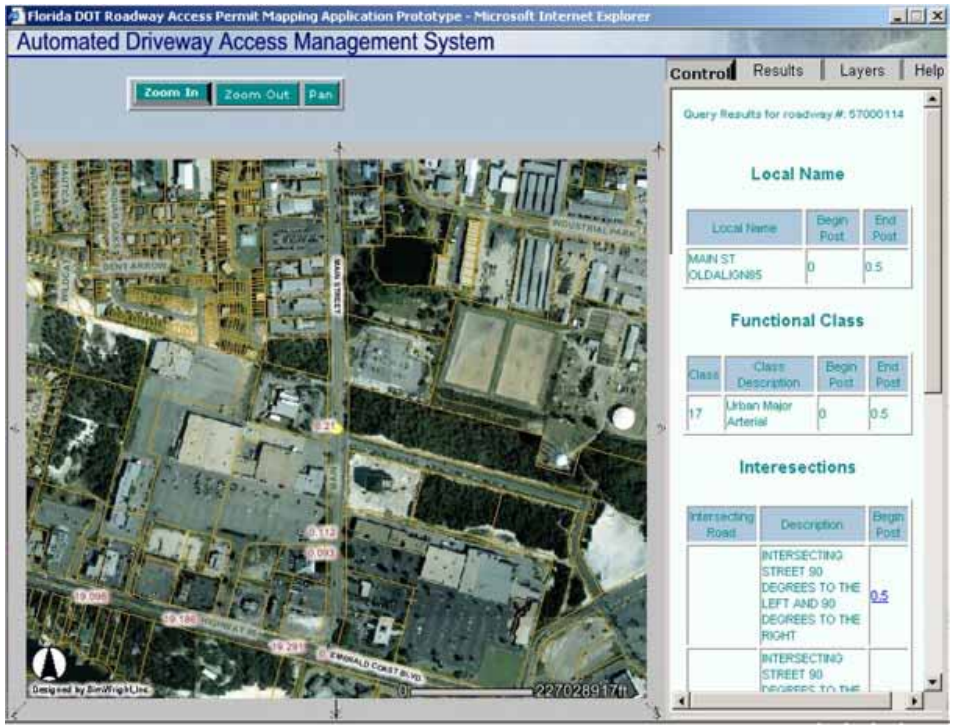


Technologies Used

Web-GIS

- Custom GIS web-applications have been used to coordinate landuse decision making between regional planning teams

- Data sharing and inter-agency coordination has been realized via web-GIS customizations for county governments



Contact Information

- Thank you !

- For more information about *ADAM* and other Web-based products, please contact us at:
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